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OFFICE OF NAVAL RESEARCH

Contract Nonr 404 (05)

Task No. NR 051-308

FINAL REPORT

POLYSOAPS

by

ULRICH P. STRAUSS

Rutgers, The State University

School of Chemistry

New Brunswick, New Jersey

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A. One of the main areas investigated was the transition from polyelectrolyte to polysoap. This work was carried out with series of poly-4-vinylpyridine derivatives prepared by quaternizing increasing percentages of the pyridine groups with n-dodecyl bromide and the remainder with ethyl bromide.

(1) The Transition from Typical Polyelectrolyte to Polysoap. I.

Viscosity and Solubilization Studies on Copolymers of 4-Vinyl-N-Ethyl-pyridinium Bromide and 4-Vinyl-N-n-dodecylpyridinium bromide. With N.L. Gershfeld, J. Phys. Chem. 58, 747 (1954)

(2) The Transition from Typical Polyelectrolyte to Polysoap. II.

Viscosity Studies of Poly-4-vinylpyridine Derivatives in Aqueous KBr Solutions. With N. L. Gershfeld and E. M. Crook, J. Phys. Chem. 60, 577 (1956)

(3) Charge Reversal of Cationic Poly-4-vinylpyridine Derivatives

in KBr Solutions. With N. L. Gershfeld and M. Spiera, J. Amer. Chem. Soc. 76, 5909 (1954)

(4) The Transition from Typical Polyelectrolyte to Polysoap. III.

Light Scattering and Viscosity Studies of Poly-4-vinylpyridine Derivatives. With B. L. Williams, J. Phys. Chem. 65, 1390 (1961)

In papers (1) and (2) the high sensitivity of the molecular dimensions and interactions of polysoap molecules to solubilizates and simple electrolytes is reported. One of the most important findings is the existence of a critical dodecyl content of the

polyvinyl-pyridine derivative at which the transition from polyelectrolyte to polysoap takes place.

The charge reversal, reported in paper (3), occurs with both polyelectrolytes and polysoaps. However, its discovery was caused by the observation of a region of insolubility found only with polysoaps. Highly significant for an understanding of macro-ions is the observation that the electrophoretic mobility is independent of the dodecyl content and of the extension of the polymer coil and depends only on the solution environment.

In paper (4) the previous findings concerning molecular dimensions and interactions in aqueous solution were confirmed quantitatively. On the other hand, no significant differences between polyelectrolytes and polysoaps were observed in an organic solvent.

B. Solubilization and its effect on polysoap behavior was further treated in the following papers:

(5) A Comparison of the Effects of Several Solubilized C_6 -

Hydrocarbons on the Viscosity of a Polysoap Solution. With L. M. Layton, J. Phys. Chem. 57, 352 (1953)

(6) A Comparison of the Solubilization of Several Paraffin

Hydrocarbons by a Polysoap. With L. M. Layton, J. Colloid Sci. 9, 149 (1954)

(7) The Effect of Solubilization on the Equivalent Conductance and Reduced Viscosity of a Polysoap Derived from

Poly-2-vinylpyridine. With S. S. Slowata, J. Phys. Chem. 61, 411 (1957)

In these papers it is shown that as progressive amounts of solubilizates are added to a polysoap solution, the viscosity decreases with aliphatic hydrocarbons, goes through a maximum with aromatic hydrocarbon and goes through both a maximum and a minimum with polar-nonpolar compounds. The causes for these effects are discussed. Results of further investigations of these phenomena by light-scattering will be presented in a post-humous report to ONR.

C. Exploratory surface activity studies of polysoaps at water-air and water-hydrocarbon interfaces have been discussed in the following paper:

(8) Exploratory Studies on the Surface Activity of Polysoaps.

With M. E. Jorgensen, J. Phys. Chem. 65, 1873 (1961)

Subsequent work concerning temporary phase separation of polysoap molecules in surface layers will be reported to ONR post-humously.

D. Auxiliary studies on the properties of the parent polymers.

(9) Light Scattering and Viscosity Studies on Poly-4-vinylpyridine. With A. G. Boyes, J. Polymer Sci. 22, 463 (1956)

Similar work on poly-2-vinylpyridine revealed some unexpected anomalies. These results will be presented to ONR in a post-humous report.

I am grateful to ONR for providing the funds which made this research possible. I appreciated especially the thoughtful administration of this project which reflected a thorough understanding by the ONR staff of the problems facing the research scientist.

Respectfully submitted,

Ulrich P. Strauss

Ulrich P. Strauss
Professor of Physical Chemistry

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Dr. R. Ullman
Department of Chemistry
Polytechnic Institute of Brooklyn
Brooklyn, New York (1)

Dr. G. Barth-Wehrenalp
Pennsalt Chemicals Corporation
P. O. Box 4388
Philadelphia 18, Pa. (2)

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Port Hueneme, California
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U. S. Naval Civil Engineering Laboratory
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